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MML TM 94-02

**COLLOCATED TUNABLE WAVENUMBER SENSOR/ACTUATORS  
FOR SMART STRUCTURES**

**N00014-92-C-0214**

**CDRL A001.16**

Covering the period: 1 January to 31 January 1994

Submitted to:

Office of Naval Research  
Scientific Officer  
Code : 1221

Submitted by:

K. Bridger  
L. Jones

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FEB 18 1994

**MARTIN MARIETTA CORPORATION**

Martin Marietta Laboratories  
1450 South Rolling Road  
Baltimore, Maryland 21227-3898  
(410) 204-2000

February 7, 1994

DTIC QUALITY INSPECTED 1

Approved for public release  
Distribution



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## Contract progress and activities since CDRL A001.15.

### Summary of progress

- Two actuator modules have just come out of burnout. This burnout took longer than anticipated due to power outages during January.
- The measurements on the smaller actuators have been repeated and agreed with the previously reported values within  $\pm 10\%$ .
- Measurements made on a glued stack showed stiffening with increasing stress from a modulus of about 4 Mpsi at 1000 psi to 12 Mpsi at 10,000 psi applied stress -- this shows the advantage of the cofired actuator.

### Telephone calls, trips, and significant results

- Bridger briefed Commander Polcari (PEO, ASTO), Ken Dial and representatives of the Navy Labs. transducer community on the use of PMN in transducers. Data from this contract were included and acknowledged.
- At 3000 psi prestress the small actuators delivered 350  $\mu$ strain at 22°C corresponding to a thrust of approximately 11,000 lb from the full-scale module -- the strain will be much greater at sea-water temperatures.

### Results bearing on prior problem areas

- None

### Programmatic changes

- None

### Technical or scheduling problem areas

- None

### Contract and cost schedule status

- Expended funds as of 30 January 1994, including expenditures prior to 23 July, were \$221K against a current budget of \$240K -- the change from last month resulted from adjusting the budget to allow for the lack of funds for the final increment.
- A revised cost schedule, beginning at the 23 July program restart, and reflecting the \$114K funding gap is attached.

### Plans for February 1994

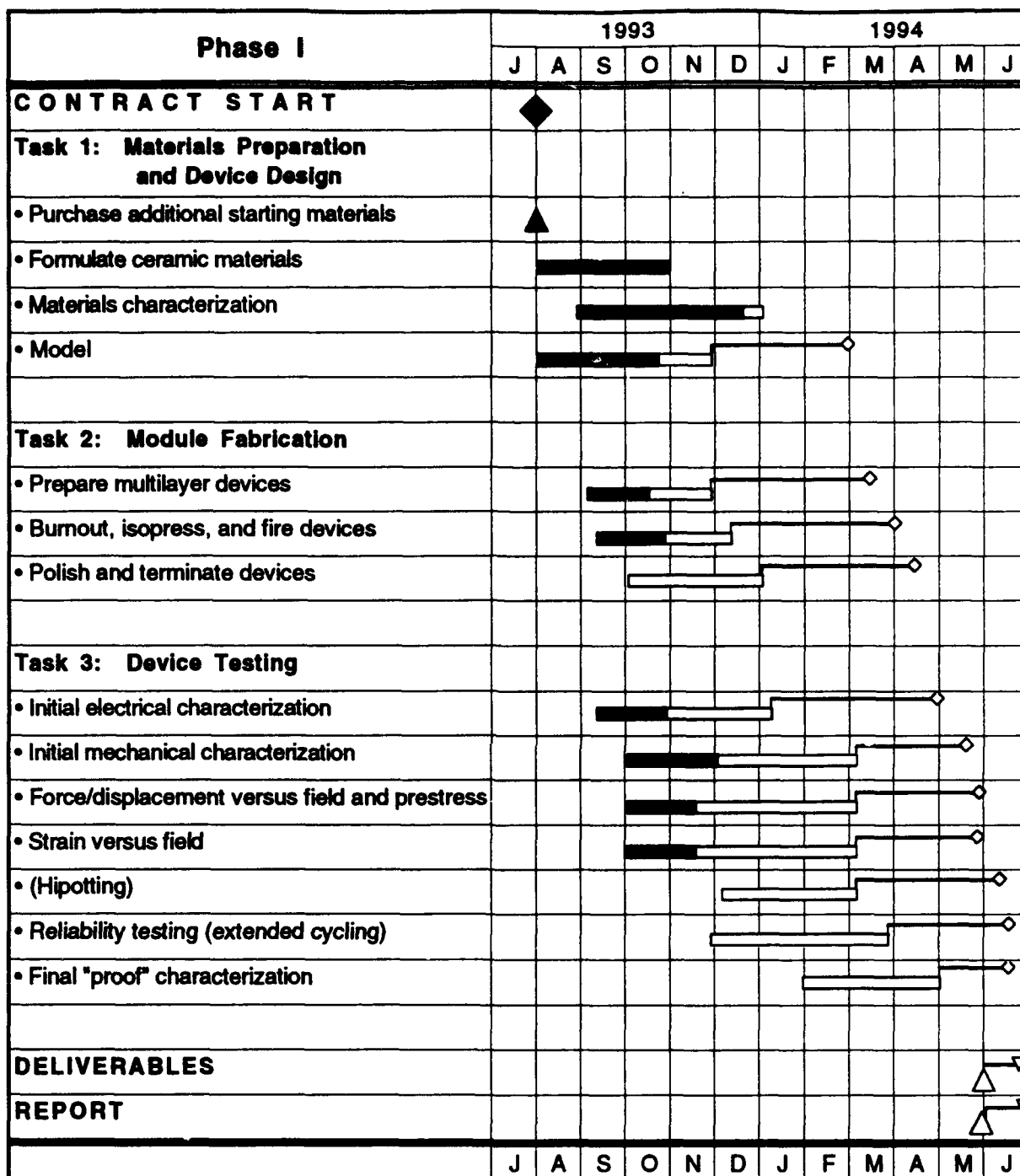
- Electromechanical measurements will be conducted on an actuator over the temperature range of interest (0-30°C)
- The two actuator modules just out of burnout will be sintered.
- The fifth and what should be final burnout iteration will be started.

### Preparers

Dr. Keith Bridger, Program Manager (410) 204-2229  
(email: BRIDGER@mml.mmc.com)  
Ms. Lori Jones, Principle Investigator (410) 204-2223  
(410) 204-2100 FAX

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# SCHEDULE, MILESTONES, AND DELIVERABLES -- Updated February 5, 1994



## KEY:

Milestone:



Planned task:



Completed task:



Task with new projected completion:

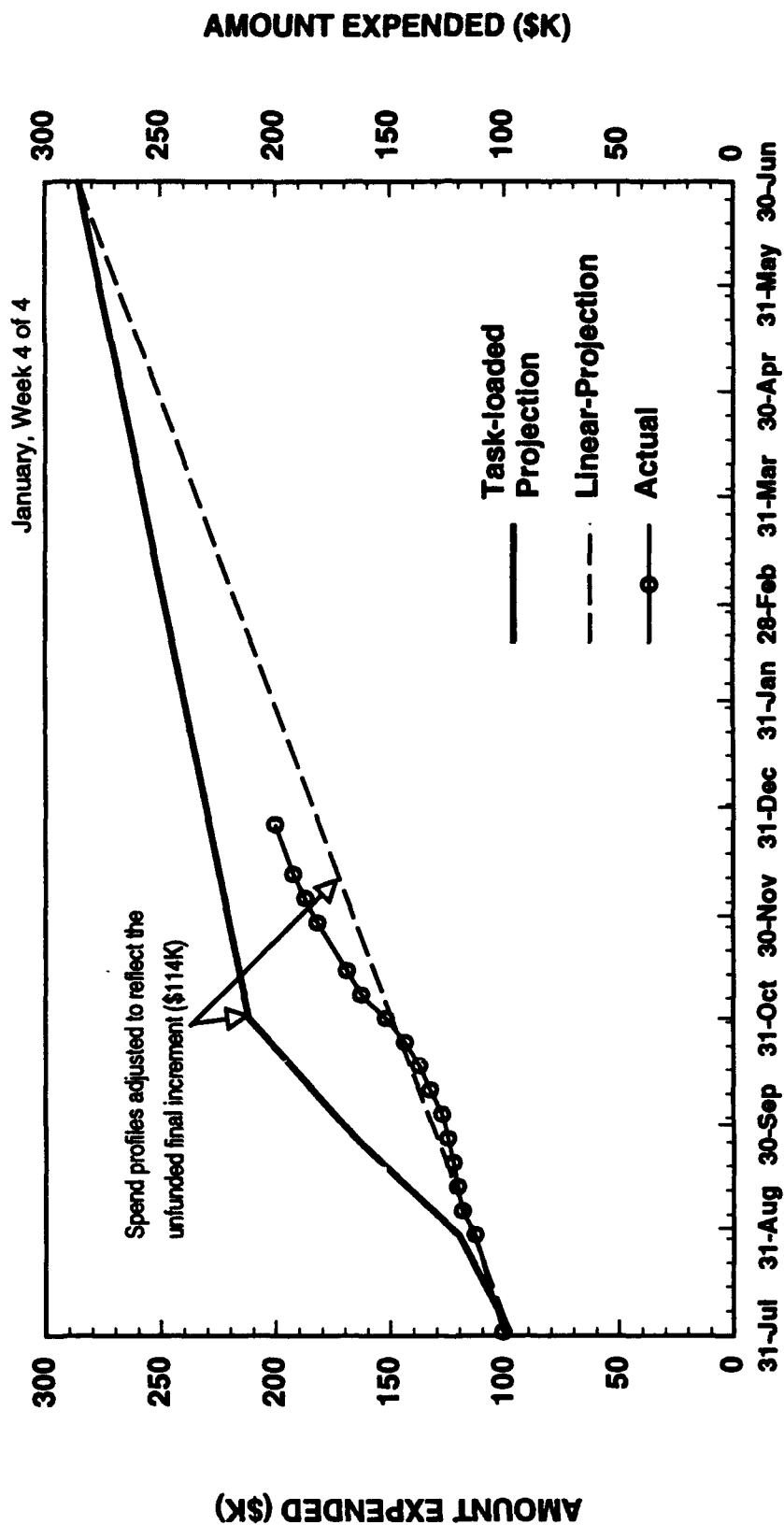


ONR Sch Miles Deliv Ph-I

Feb 7, 1994

# EXPENDITURE CHART

3117-000 ONR  
Co-Fired High-Force Actuators



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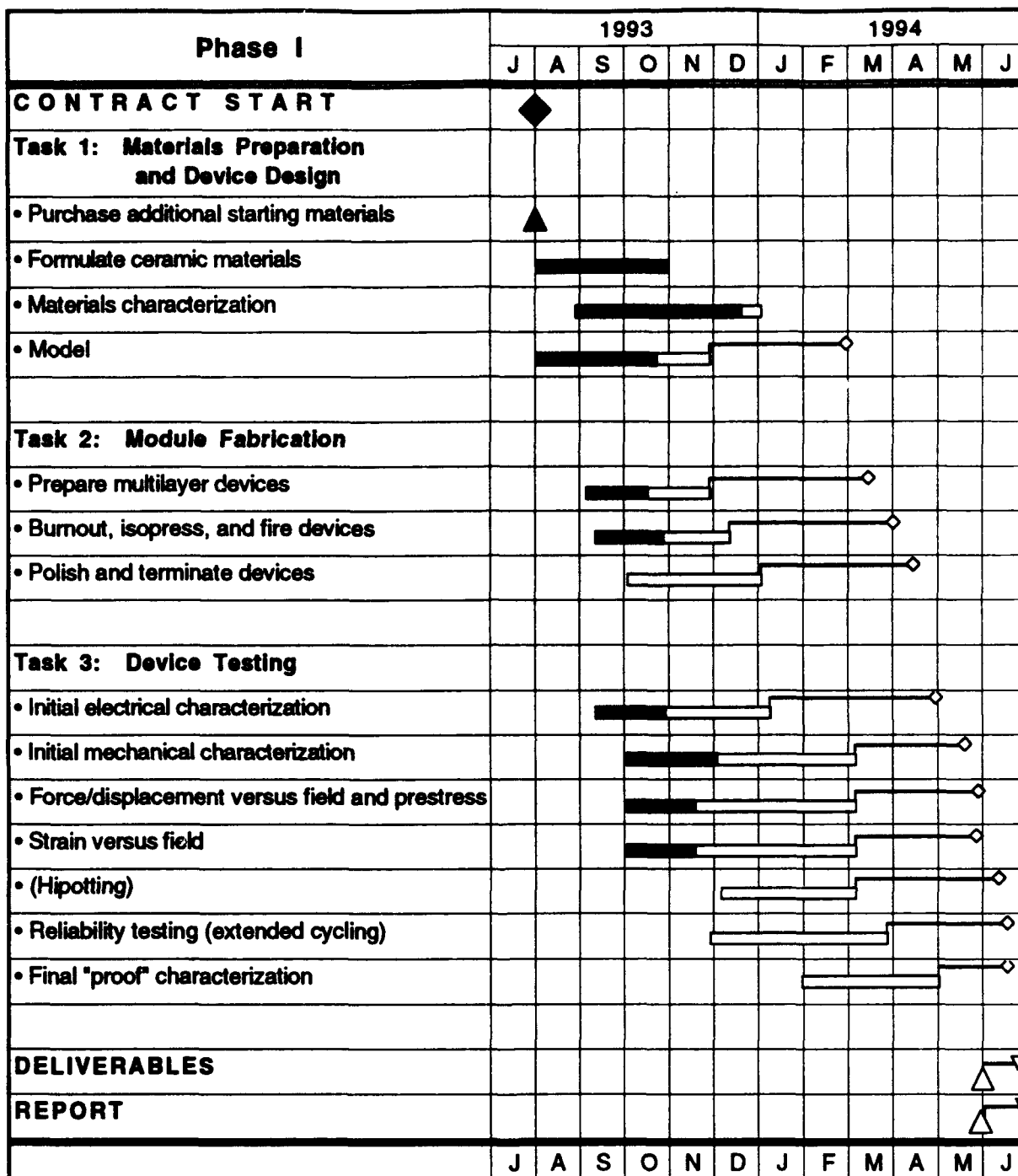
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